Central Tare Laboratory Operaton

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Introduction

The Utah-Idaho Sugar Company has established two semi-automatic central tare and individual sugar content laboratories to process samples from four of the company's five factory districts. The first was installed at Moses Lake, Washington in the fall of 1966 and receives beets from the Columbia Basin and Toppenish districts in Washington. The second laboratory was built at Garland, Utah a year later to handle samples from the Garland and Southern Utah districts. Overall operation of the new laboratories has been quite successful and marred only by the new process start-up "bugs".

Description of Equipment

The laboratories are equipped with an integrated system of sample cleaning, taring and weighing equipment. Extensive use has been made of electronic data gathering equipment and readout devices. Through an interlocked system of micro-switches and photo cells the beets themselves control the movement of samples through the cleaning and taring equipment. Some changes have been made based on experience and an improved washer-dryer design used in the second installation; however, the overall system design has not been changed from the original. In addition to the change in washer design, the Garland laboratory differs by having a mechanical second scale and one rather than two, Weibull sugar analysis lines.

The washer-dryer and taring stations designs were developed by Utah-Idaho Sugar Company in conjunction with Ogden Iron Works. Load cell scale systems and sugar content readout equipment were fabricated by Ormond Inc. of Los Angeles. Sugar content analysis equipment was furnished by Weibull A.B. of Malmo, Sweden, modified to the extent of using Bendix Automatic Polarimeters instead of the servo balance type used in Europe.

Description of Operation

Tare samples are taken from loads as received at the stations.

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They are placed in rubberized nylon bags and an identifying ticket is placed in a special pocket on the outside of the bag. The sample bags are equipped with a snap strap closure and have a large ring attached to the bottom. The bags are then placed in wooden tote bins each holding 25 to 30 samples for transport by truck to the laboratory. At the laboratory the bins are removed by fork lift and placed on the loading dock. The sample bags are taken from the bin and hung by the bottom ring on Chainveyor belts. The carriers are moved into the laboratory by a power chain and positioned over the washer feed hopper. The section of Chainveyor track over the hopper is part of a load cell scale linked to a printing calculator. After the sample is positioned the operator enters the total weight and empties the sample into the hopper. The operator takes the identity card from the pocket and places it in the printer. The weight of the empty bag and carrier is then entered. The calculator subtracts the second entry from the first and prints out the net weight of the sample as received. The card is then placed in the card conveyor which moves the identity card to the second scale position. The motion of this conveyor is linked to the washer and dryer so that the sample and card arrive at the second scale together. When the card is placed in the first position on the conveyor, it trips the hopper and moves the sample to the washer.

Figure 1.—Samples being loaded on Chainveyor for transport into the tare laboratory.

The washer is a horizontal eight-sided drum with a spiral flight welded into the inside. As it revolves (2-3 rpm) the beets remain in essentially the same position on its circumference, just past the bottom of the drum. In effect a series of compartments are formed which move through the drum as it revolves.

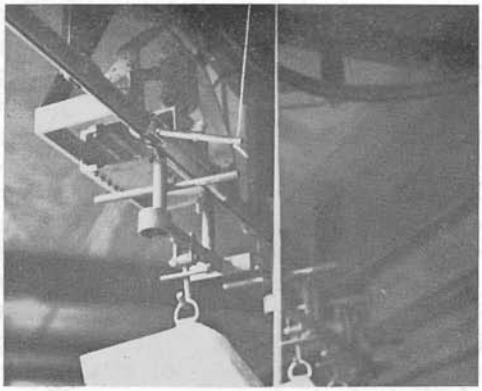

Figure 2.—Load cell scale portion of Chainveyor track with sample carrier in position for weighing.

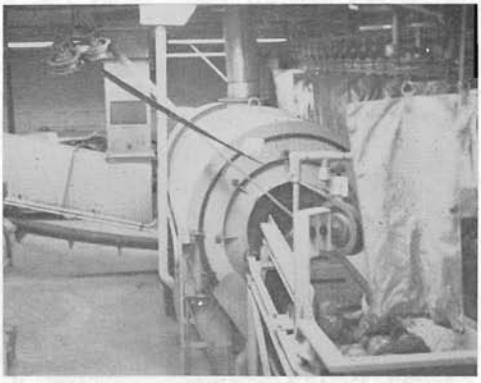

Figure 3.—Carver-Ogden sample washer showing sample feed belt and card conveyor.

A row of nozzles is fixed to spray the beets with a stream of water at 120-160 psi effectively removing all the soil and mud. From the washer the beets move to the dryer.

In the first installation the dryer is a compartment belt moving in a tunnel of warm air. In the Garland unit it is integrated with the washer and forms the last five compartments. By using this construction, operation is improved and maintenance greatly simplified. We feel that the washer-dryer design is a contributing factor to the overall success of the tare operation. The dryer discharges into a hopper convenient to the top tare operators.

The samples are crowned by hand using the standard two bladed rotary topping machine and placed in a scale feeding hopper. The second scale is a tilting pan load cell unit equipped with a card printer. At Garland the topped samples are placed

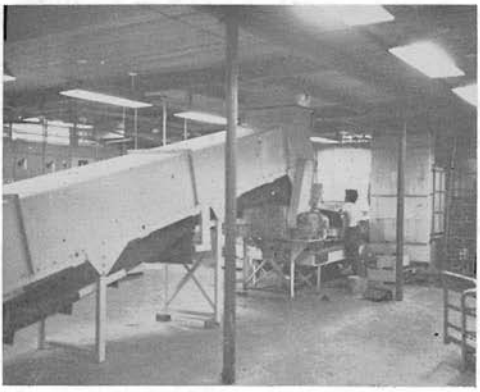

Figure 4.—Moses Lake tunnel dryer and top tare station. The housing for the Weibull sampling saws can be seen on the operator's right.

directly in the hopper mounted on a platform scale equipped with a card printer. After recording the weight the operator then dumps the sample onto a belt which feeds the Weibull sampling equipment. The top tare from the topping machines is also placed on this belt so that both are put through the sugar sampling equipment. By the addition of the tare material, the resultant sugar analysis more truly represents the sugar content of the beets as delivered to the pile.

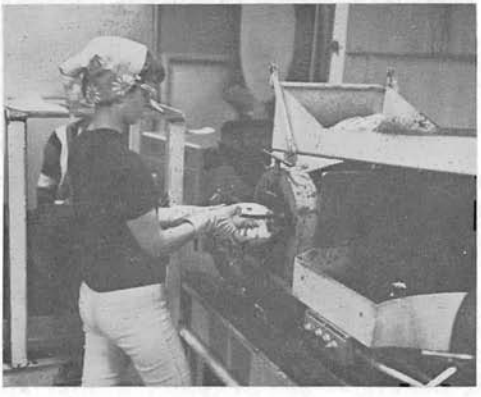

Figure 5.—Operator top taring beet before second weighing.

The samples go into a slotted skip which moves through a pair of circular saws. These saws, 30 inches in diameter with 1 inch teeth, give a rather coarse, dry pulp that does not stick to handling equipment. The pulp is mixed by a pair of rotating rubber blades which also transfer it from one belt to a second. The mixed brei is then transferred to a third belt that is approxi-

mately 2 in wide. This 2 in belt then carries the brei to a tared metal cup on a proportioning balance. The balances are set up to take 80± 10 gm of pulp and dispense proportionately 3× pulp minus 10 gm of water. The water is dumped into the pulp cup which is then placed on the Weimix table.

This table consists of a circular set of eight individual mixers each with a four-bladed cutter rotating at 12,000 rpm. The table rotates at approximately ¼ rpm. A sample cup is placed on each mixer as it passes the scale operator. As the cup moves around the table it activates a switch which turns the mixer on, and 2.5 minutes later a switch which turns the mixer off. Just as the mixer is turned off a 10 ml aliquot of 51 brix (Sp.Gr. 1.250) lead acetate solution is added and mixed by the cutter as it coasts to a stop. The balance operator then removes the cup and places it on a lower section of the table where it moves to the second operator at the filter station.

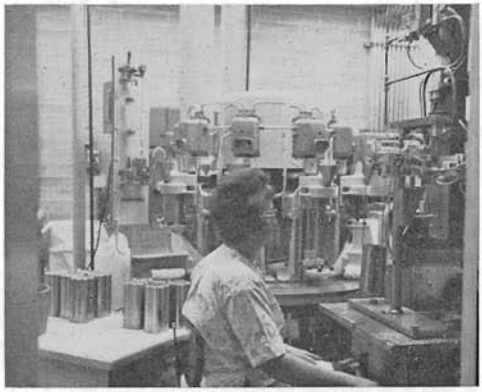

Figure 6.—Operator weighing sample for sugar analysis. (Weibull proportioning balance right; Weimix table, center; Lead acetate delivery apparatus, left).

The filtration and polarization are accomplished by means of a rather clever and elaborate system of solenoid valves and time switches. The sample cup is removed from the lower section of the Weimix table and placed under a filter apparatus. This consists of a frame with goose necks for three samples in sequence. The filter paper is a plug of compressed tissue paper which is placed in a thimble at the end of the gooseneck. This filter is lowered into the sample cup and an activating button pressed. The sequence stepping system then takes over. Suction is first applied for approximately 70 seconds. The sample is drawn into a chamber equipped with a float valve which stops flow when full. The lower portion of this chamber is isolated from the

upper in order to hold the initial filtrate which might be cloudy. At the end of 70 sec the valves reverse and air pressure is applied to blow the contents of the upper portion of the receiving chamber into a funnel from which it flows to the polarimeter

Figure 7.—Operator filtering and polarizing sample.

chamber. The lower valves then switch and the remainder of the sample and the filter are blown back into a sample cup. The cup is dumped and placed upside down on the lower section of the Weimix table where it moves through a washer and hot air dryed and is cooled to room temperature with cold air. The cup is now back to the balance operator where it can be removed and used again.

The sample, meanwhile, flows into the cell of the Bendix Automatic Polarimeter coupled to digital printing system. The identifying card which accompanied the sample through the Weimix equipment is placed in the printer and the sugar content recorded. The printed cards are collected and taken to the data handling centers where the dirty and clean weights, sugar content and identification information are transmitted to the computer in Salt Lake City. The average tare and sugar content for each grower are calculated and sent back to the corresponding receiving station by way of the respective factory offices.